Dms 2014

Industrial Hygiene
JUN 19 1989

Monsanto

MONSANTO PRODUCT NAME

SKYDROL® LD-4 FIRE RESISTANT
HYDRAULIC FLUID

MONSANTO COMPANY
800 NORTH LINDBERGH BLVD.
ST. LOUIS, MO 63167
EMERGENCY PHONE NO.
(CALL COLLECT)
(314) 694-1000

PRODUCT IDENTIFICATION

Skydrol® LD-4 fire resistant hydraulic fluid is a proprietary product. The formulation is a trade secret of Monsanto Company. All components of Skydrol LD-4 hydraulic fluid appear on the Inventory of Chemical Substances published by the U.S. Environmental Protection Agency (EPA) under the authority of the Toxic Substance Control Act (TSCA).

Chemical Family: Phosphate Esters with performance additives.

DOT Hazard Class: This product is not classified as a hazardous material by the U.S. Department of Transportation

DOT Label(s): Not Applicable

U.S. Surface Freight Classification: Hydraulic Systems Fluid, other than Petroleum.

Report Quantity (RQ) Under U.S. EPA CERCLA Regulations: Not Listed

SARA Hazard Notification

Hazard Categories Under Criteria of SARA Title III Rules (40 CFR Part 370): Immediate

Section 313 Toxic Chemical(s): Not Applicable

Hazardous Chemical(s) Under OSHA Hazard Communication Standard: This product contains, as components, the substances listed below which are identified as hazardous chemicals under the criteria of the OSHA Hazard Communication Standard (29 CFR 1910.1200):

Tributyl Phosphate (CAS No. 126-73-8)
Dibutyl Phenyl Phosphate, (CAS No. 2528-36-1)
2,6-Di-tert-Butyl-p-Cresol, (CAS No. 128-37-0)

WARNING STATEMENTS

CAUTION!
MAY CAUSE IRRITATION TO EYES, SKIN, AND RESPIRATORY TRACT

PRECAUTIONARY MEASURES

Avoid contact with eyes, skin, and clothing.
Avoid breathing vapor or mist.
Use with adequate ventilation.
Keep container closed.
Wash thoroughly after handling.

Emptied container retains vapor and product residue. Observe all labeled safeguards until container is destroyed. DO NOT REUSE THIS CONTAINER.

EMERGENCY AND FIRST AID PROCEDURES

FIRST AID: IF IN EYES, immediately flush with plenty of water for at least 15 minutes. Call a physician if irritation persists.

IF ON SKIN, immediately flush with plenty of water. Wash clothing before reuse.

IF INHALED, remove to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. If breathing is difficult, give oxygen. Call a physician.

OCCUPATIONAL CONTROL PROCEDURES

Eye Protection: Wear chemical splash goggles and have eye baths available where there is significant potential for eye contact.

Skin Protection: Wear appropriate protective gloves that provide a barrier and protective clothing to prevent skin contact. Consult glove manufacturer to determine appropriate type glove for given application. Wear a face shieldand an apron that provides a barrier when splashing is likely. Wash contaminated skin promptly. Launder contaminated clothing and clean protective equipment before reuse. Wash thoroughly after handling.

Respiratory Protection: Handling this product at room temperature should not present an inhalation hazard since the material has a low vapor pressure. If the material is heated and released or aerosolized in a mist form in excessive

OCCUPATIONAL CONTROL PROCEDURES (CONTINUED)

concentrations, use NIOSH/MSHA approved respiratory protective equipment. Consult respirator manufacturer to determine the appropriate equipment type for given application. Respiratory protection programs must be in compliance with the OSHA Respiratory Protection Standard (29 CFR 1910.134).

Ventilation: No special ventilation is required besides good room ventilation. If heated material is released or aerosolized, local mechanical exhaust ventilation should be used at the source of air contamination.

Airborne Exposure Limits:

Tributyl Phosphate

OSHA PEL/TWA:	2.5 mg/m^3 (0.4 ppm) 8 Hour
ACGIH TLV/TWA:	2.5 mg/m^3 (0.2 ppm) 8 Hour
ACGIH TLV/STEL:	5 mg/m^3 (0.4 ppm) Short-term exposure limit

Dibutyl Phenyl Phosphate

OSHA PEL:	None Established
ACGIH TLV:	None Established

2,6-Di-tert-Butyl-p-Cresol

OSHA PEL/TWA:	10 mg/m^3 8-Hour TWA
ACGIH TLV/TWA:	10 mg/m^3 8-Hour TWA
ACGIH TLV/STEL:	20 mg/m^3 short-term exposure limit

FIRE PROTECTION INFORMATION

Flash Point:	320°F	Method:	Cleveland Open Cup
Fire Point:	350°F	Method:	Cleveland Open Cup
Autoignition Temp.:	750°F	Method:	ASTM D-2155

Extinguishing Media: Water spray, foam, dry chemical, carbon dioxide or any Class B extinguishing agent.

Special Fire Fighting Procedures: Fire fighters or others exposed to products of combustion should wear full protective clothing including self-contained breathing apparatus. Equipment should be thoroughly decontaminated after use.

Unusual Fire and Explosion Hazards: Products of decomposition include hazardous carbon monoxide, carbon dioxide, and oxides of phosphorus.

REACTIVITY DATA

Stability: Product is stable under ordinary conditions of handling and storage and under continued use up to approximately 250-275°F.

Materials to Avoid: Exposure to strong oxidizing agents may result in generation of heat and combustion products.

Hazardous Decomposition Products: Oxides of phosphorus may form. No other uniquely hazardous decomposition products are expected. If the product is burned, as with any organic material, carbon monoxide, and soot can be produced.

Hazardous Polymerization: Does not occur.

HEALTH EFFECTS SUMMARY

The following information presents both human experience and the results of scientific experiments used by qualified experts to assess the effects of Skydrol LD-4 fire resistant hydraulic fluid on the health of industrially exposed individuals and to support the Precautionary Statements and Occupational Control Procedures recommended in this document. To avoid misunderstanding, the data provided in this section should be interpreted by individuals trained in evaluation of this type of information.

Human Experience

Dermal contact and inhalation are expected to be the primary routes of occupational exposure to Skydrol LD-4 fire resistant hydraulic fluid. Eye contact with this product has been reported to produce marked pain in the eyes but has not been reported to cause damage to the eyes. Irritation in the form of drying and cracking of exposed skin may be caused by repeated or prolonged skin contact with this material. Exposure to the aerosolized Skydrol LD-4 fluid or vapors of Skydrol LD-4 hydraulic fluid produced at high temperatures has been reported to produce nose and throat irritation accompanied by coughing and wheezing. Inhalation of Tributyl Phosphate, a component of Skydrol LD-4 at concentrations above the recommended TLV may cause nausea and headache.

Toxicological Data

Data from Monsanto studies indicate the following:

Skydrol® LD-4 fire resistant hydraulic fluid

Oral LD_{50} (Rat): 2,100 mg/kg, Slightly Toxic
Dermal LD_{50} (Rabbit): Greater than 3,160 mg/kg, No more than Slightly Toxic
Eye Irritation (Rabbit): (FHSA) 12.3 on a scale of 110.0, Slightly Irritating
Skin Irritation (Rabbit): (FHSA) 3.7 on a scale of 8.0, Moderately Irritating

HEALTH EFFECTS SUMMARY (CONTINUED)

Vapor Inhalation 4-hr LC_{50} (Rat): Greater than 5.8 mg/l. No mortality was observed at 5.8 mg/l, the highest atmostpheric concentration achievable in this study.

Components

Data from Monsanto studies and from the available literature on the components of Skydrol LD-4 hydraulic fluid which have been identified under the criteria of the OSHA Hazard Communication Standard (29 CFR 1910.1200) are discussed below:

Tributyl Phosphate

Single intraperitoneal injections of Tributyl Phosphate at dosages of 850 to 1,000 mg/kg were reported to cause paralysis in mice.

A neurotoxicity study was conducted with Tributyl Phosphate in adult hens. Adult hens were dosed orally with a single dose of 1.84 g/kg. This dose was repeated 21 days later. No gross signs of neurological effects and no microscopic evidence of demyelination in brain, spinal cord or sciatic nerve were observed.

Tributyl Phosphate was administered to rats by gavage at doses of 0.28 and 0.42 ml/kg/day for 14 consecutive days. Decreased body weights were reported in all treatment groups at 7 days and in low-dose females at 14 days. Conduction velocity of the caudal nerve was reduced in high-dose males. Increases in refractory periods of caudal nerve were reported in high- and low-dose groups. Morphological alterations in unmyelinated fibers were reported in the high-dose groups. No axonal degeneration was observed.

Rats were administered Tributyl Phosphate by gavage at doses of 0.14 to 0.42 ml/kg/day for 14 consecutive days. Alterations in organ weights and hematological and biochemical parameters were reported in low- and/or high-dose treatment groups. One of 4 male rats in the high-dose group examined for histopathological changes was reported to show degenerative changes in the seminiferous tubules. No other histopathological abnormalities were observed.

Reduced body weights, reduced feed consumption and altered organ weights with decreased serum enzyme and glucose levels and increased cholesterol and/or urea nitrogen levels were reported in male rats fed dietary concentrations of 0.5% and 1.0% Tributyl Phosphate for 10 weeks. Blood coagulation times were also prolonged following this *in vivo* treatment with Tributyl Phosphate, brain cholinesterase activity was significantly elevated. Activities of serum and liver cholinesterase did not change. Following *in vitro* treatment of rat brain and liver homogenates and serum with Tributyl Phosphate, no change in cholinesterase activities were reported.

HEALTH EFFECTS SUMMARY - CONTINUED

Rats were fed diets containing Tributyl Phosphate at levels of 8, 40, 200, 1,000 or 5,000 ppm for 90 days. Hematological, biochemical, and coagulation parameter changes and increased liver weights were reported in the high-dose animals. Urinary bladder hyperplasia was observed among male and female rats at 5,000 ppm and among males given 1,000 ppm. In a separate study, male and female rats given Tributyl Phosphate by gavage at levels of 0.20 and 0.30-0.35ml/kg/day 5 days/week for 18 weeks were also reported to exhibit urinary bladder hyperplasia.

Another feeding study was conducted in rats with Tributyl Phosphate at a dietary level of 0.5% for 9 weeks. Decreased body weights and altered organ weights with increased urea nitrogen levels were reported. No adverse effects on hematological parameters, blood coagulation time, or serum enzyme activities were reported.

Cholinesterase activities of human red cell hemolysate (substrate concentration $1x10^{-3}$ M acetylcholine) and human plasma (substrate concentration $1x10^{-2}$ M acetylcholine) were reported to be inhibited by Tributyl Phosphate in vitro.

Tributyl Phosphate administered intraperitoneally to rats at dosages ranging from 16 to 226 mg/kg produced a dose-dependent increase in serum -glucuronidase activity. No effect on serum cholinesterase activity was reported at any dose level tested.

No mutagenic activity was reported in microbial assays using Salmonella and Escherichia organisms or in a sex-linked dominant lethal assay in Drosophila.

Following a single oral dose (14 mg/kg) of radiolabeled Tributyl Phosphate to male rats, 50%, 10% and 6% of the administered radiolabel was reported to be excreted in urine, exhaled air and feces, respectively, within one day. Male rats given a single intraperitoneal dose (14 mg/kg) of radiolabeled Tributyl Phosphate were reported to excrete 70%, 7% and 4% of the administered radiolabel in urine, exhaled air, and feces, respectively, within one day.

Dibutyl Phenyl Phosphate

Patch testing of 50 human volunteers with Dibutyl Phenyl Phosphate produced positive reactions in 2 out of 50 subjects following the first two applications; no positive reactions were observed during subsequent repeated induction exposures. No reaction was observed on challenge. Dibutyl Phenyl Phosphate is not considered a primary irritant or a sensitizing agent.

A neurotoxicity study was conducted with Dibutyl Phenyl Phosphate in adult hens. Adult hens were dosed orally with a single dose of 1.34 g/kg. This dose was repeated 21 days later. No gross signs of neurological effects and no microscopic evidence of demyelination in brain, spinal cord or sciatic nerve were observed.

HEALTH EFFECTS SUMMARY - CONTINUED

Dibutyl Phenyl Phosphate was applied to the intact and abraded skin of rabbits at dosages of 10, 100, and 1,000 mg/kg/day for 6 hours/day, 5 days/week for 3 weeks. Dermal irritation was observed at the site of application. Significant reductions of plasma cholinesterase activity were determined for high-dose males and females and for mid-dose males. Slight reductions in brain and erythrocyte cholinesterase activities were determined for high-dose males and females and for high-dose males, respectively. No other adverse biochemical, hematological or urinalysis effects were observed. The systemic no-effect level was considered to be 10 mg/kg/day.

Dibutyl Phenyl Phosate was administered to rats at dietary concentrations evquivalent to 50, 150 or 500 mg/kg/day for 90 days. Decreased body weight gains and food consumption were observed at the high-dose exposure level. Increased liver weight/liver-to-body weight ratios and decreased lung weights were observed in the mid- and/or high-dose exposure groups. Hematologic parameter alterations were reported in all treatment groups; biochemical parameter alterations were reported in the high-dose group. Histopathologic lesions were noted in liver, kidneys, bladder and ovaries of most treatment groups.

In a subsequent 90-day study, rats were administered Dibutyl Phenyl Phosphate in the diet of a dosage of 5 mg/kg/day. No adverse hematological or histopathological effects and no changes in plasma or erythrocyte cholinesterase activity were observed.

No teratogenic or fetotoxic effects were observed in the offspring of rats administered Dibutyl Phenyl Phosphate by gavage at a dosage of 3, 30 or 300 mg/kg/day on days 6 through 15 of gestation. No maternal toxic effects were observed at any treatment level.

Dibutyl Phenyl Phosphate was evaluated for mutagenic or genotoxic potential in the following systems: microbial assays with five Salmonella strains and one strain of Saccharomyces yeast; in vitro induction of L5178Y TK mouse lymphoma cell point mutations; and a hepatocyte primary culture/DNA repair assay. No mutagenic activity was observed in any of these assays.

2,6-di-tert-Butyl-p-Cresol

A Threshold Limit Value (TLV) has been established by the American Conference of Governmental Industrial Hygienists (ACGIH) for 2,6-du-tert-Butyl-p-Cresol, a minor component of Skydrol LD-4 fire resistant hydraulic fluid. For further information on 2,6-di-tert-Butyl-p-Cresol, please refer to manufactuer's material safety data sheet and the current edition of the Documentation of Threshold Limit Values.

HEALTH EFFECTS SUMMARY (CONTINUED)

Additional Information

A Threshold Limit Value (TLV) has been established by the American Conference of Governmental Industrial Hygienists for Tributyl Phosphate. For further information on Tributyl Phosphate, please refer to the current edition of the Documentation of Threshold Limit Values.

PHYSICAL DATA

Appearance: Clear, purple, oily liquid

Boiling Point @ 380 mm Hg (Based on Vapor Pressure Data): Approximately 257°F

Pour Point: Less than -80°F (Maximum)

Specific Gravity (25/25°C): 1.004-1.014

Viscosity @ 100°F: 10.8-11.6 cs

Refractive Index, n 25/D: 1.443-1.451

NOTE: These physical data are typical values based on material tested but may vary from sample to sample. Typical values should not be construed as a guaranteed analysis of any specific lot or as specifications for the product.

SPILL, LEAK AND DISPOSAL INFORMATION

Emergency Spill and Leak Information: Absorb spilled or leaked material on clay, sawdust, or other absorbent material and dispose of as recommended below.

Disposal Information: Waste should be incinerated or disposed of in a hazardous waste landfill. Either disposal route should be in accordance with all local, state or federal regulations. This material should be not be spilled, dumped, rinsed, or washed into sewers or public waterways.

ENVIRONMENTAL EFFECTS

Skydrol LD-4

48-hr EC_{50} Daphnia magna: 5.8 mg/1, Moderately Toxic
48-hr EC_{50} Algae (Chlorophyll): 8.2 mg/1, Moderately Toxic
96-hr EC_{50} Algae (Cell Count): 10 mg/1, Moderately Toxic

ENVIRONMENTAL EFFECTS - CONTINUED

96-hr LC_{50} Fathead Minnow: 4.8 mg/l, Moderately Toxic
96-hr LC_{50} Rainbow Trout: 5.2 mg/l, Moderately Toxic

Tributyl Phosphate

Tributyl Phosphate was evaluated in a semi-continuous activated sludge test, the Thompson-Duthie-Sturm biodegradation assay and in a river die-away test. Based on results from these assays, Tributyl Phosphate was classed as readily degraded.

Dibutyl Phenyl Phosphate

96-hr TC_{50} Bluegill Sunfish: Estimated to be between 1 and 10 ppm, Moderately Toxic
14-Day LC_{50} Rainbow Trout: 2.4 mg/l

Daphnia magna were exposed to Dibutyl Phenyl Phosphate concentrations of 0.014, 0.028, 0.055, 0.092 and 0.25 mg/l through one generation (21 days). Increased mortality, reductions in the total length of Daphnia at 7 days and reductions in the percent of gravid females were observed at 0.25 mg/l. The maximum acceptable toxicant concentration was greater than 0.092 mg/l and less than 0.25 mg/l.

Rainbow trout eggs were exposed to Dibutyl Phenyl Phosphate concentrations ranging from 0.007 to 0.110 mg/l. No treatment-related effects were observed on hatchability of eggs or on growth and survival of the fry. The maximum acceptable toxicant concentration was greater than 0.110 mg/l.

Dibutyl Phenyl Phosphate had a primary degradation rate of greater than 95% in a semi-continuous activated sludge test; this material was classified as readily degraded. In a river die-away study, Dibutyl Phenyl Phosphate was classified as being readily degraded.

Product Qualifies under the following specifications:

BMF 3-11F, Type IV, Class 2, Grade A
DMS 2014C, Type IV, Class 2
LAC MS C-34-1224, Type IV
SAE AS 1241A, Type IV, Class 1
NSN 9150-01-096-6497 (1gal)

DATE 5/22/89 **SUPERSEDES** 4/18/86

MSDS NUMBER M00006727

FOR ADDITIONAL NON-EMERGENCY INFORMATION, CONTACT:

MSDS Coordinator
Specialties Division
Monsanto Chemical Company
(314) 694-1000
(A Unit of Monsanto Company)

==========

NOTICE: Although the information and recommendations set forth herein (hereinafter "Information") are presented in good faith and believed to be correct as of the date hereof, Monsanto Company makes no representations as to the completeness or accuracy thereof. Information is supplied upon the condition that the persons receiving same will make their own determination as to its suitability for their purposes prior to use. In no event will Monsanto Company be responsible for damages of any nature whatsoever resulting from the use of or reliance upon Information. NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OF ANY OTHER NATURE ARE MADE HEREUNDER WITH RESPECT TO INFORMATION OR THE PRODUCT TO WHICH INFORMATION REFERS.

==========

1170